Advanced Light Source

Beamline Information

Beamline	Source*	Areas of Research/Techniques	Energy Range	Operational
1.4.1	Bend	Ultraviolet Photoluminescence	1.6–6.2 eV	Now
1.4.2	Bend	Visible and Infrared Fourier Transform Spectroscopy (FTIR)	0.002–3 eV	Now
1.4.3	Bend	Infrared Spectromicroscopy	0.05–1 eV	Now
3.1	Bend	Diagnostic Beamline	1–2 keV	Now
3.3.1	Bend	Commercial Deep-Etch X-Ray Lithography (LIGA)	3–12 keV	Now
3.3.2	Bend	Deep-Etch X-Ray Lithography (LIGA)	1–20 keV	Now
4.0.2	EPU5	Magnetic Spectroscopy	52–1900 eV	Now
4.2.2	SB	Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography	6–18 keV	2002
5.0.1	W16	Monochromatic Protein Crystallography	12.4 keV	Now
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5.0.3	W16	Monochromatic Protein Crystallography	12.4 keV	Now
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6.1.2	Bend	High-Resolution Zone-Plate Microscopy	300–900 eV	Now
6.3.1	Bend	Calibration and Standards, EUV/Soft X-Ray Optics Testing, Solid-State Chemistry	500–2000 eV	Now
6.3.2	Bend	Calibration and Standards; EUV Optics Testing; Atomic, Molecular, and Materials Science	50–1300 eV	Now
7.0.1	U5	Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism	50–1200 eV	Now
7.3.1.1	Bend	Magnetic Microscopy, Spectromicroscopy	175–1500 eV	Now
7.3.1.2	Bend	Surface and Materials Science, Micro X-Ray Photoelectron Spectroscopy	175–1500 eV	Now
7.3.3	Bend	X-Ray Microdiffraction	6–12 keV	Now
8.0.1	U5	Surface and Materials Science, Imaging Photoelectron Spectroscopy, Soft X-Ray Fluorescence	65–1400 eV	Now
8.2.1	SB	Multiple-wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography	6–18 keV	Now
8.2.2	SB	Multiple-Wavelength Anomalous Diffraction (MAD) and monochromatic protein crystallography	6–18 keV	2002
8.3.1	SB	Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography	2.4–15 keV	Now
8.3.2	SB	Tomography	3–60 keV	2003
9.0.1	U10	Coherent Optics/Scattering Experiments	10–800 eV	Now
9.0.2	U10	Chemical Reaction Dynamics, Photochemistry, High-Resolution Photoelectron and Photoionization Spectroscopy, Photoelectron and Photoionization Imaging and Spectroscopy	5–30 eV	Now
9.3.1	Bend	Atomic, Molecular, and Materials Science	2.2–6 keV	Now
9.3.2	Bend	Chemical and Materials Science, Circular Dichroism, Spin Resolution	30–1400 eV	Now
10.0.1	U10	Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics	17–340 eV	Now
10.3.1	Bend	X-Ray Fluorescence Microprobe	3–20 keV	Now
10.3.2	Bend	Environmental and Materials Science, Micro X-Ray Absorption Spectroscopy	2.5–17 keV	Now
11.0.2	EPU5	Molecular Environmental Science	75–2000 eV	2002
11.3.1	Bend	Small-Molecule Crystallography	6–17 keV	2002
11.3.2	Bend	Inspection of EUV Lithography Masks	50–1000 eV	Now
12.0.1	U8	EUV Optics Testing and Interferometry, Angle- and Spin-Resolved Photoemission	60–320 eV	Now
12.2.2	SB	California High-Pressure Science Observatory (CALIPSO)	6–40 keV	2002
12.3.1	SB	Multiple-Wavelength Anomalous Diffraction (MAD) Protein Crystallography and Small-Angle X-Ray Scattering (SAXS)	6–18 keV	2002
BTF	Linac	Beam Test Facility	50-MeV electrons	Now

*Bend = bend magnet
EPU5 = 5-cm-period ellipticall polarization undulator
W16 = 16-cm-period wiggler
Ux = x-cm-period undulator
SB = superconducting bend magnet

Beamline 1.4.1
Ultraviolet Photoluminescence

Operational	Now
Source characteristics	Bend magnet
Energy range	1.6–6.2 eV
Frequency range	180–750 nm
Monochromator	0.5 m single grating
Measured flux	10^{13} photons/s/nm (300–700 nm) $> 10^{12}$ photons/s/nm (180–300 nm)
Measured resolving power ($\Delta E/E$)	10^{-4} (at 300 nm)
Spectrometer resolution	Depends on slit size
Endstations	Optical table
Spatial resolution	Diffraction limited
Detectors	Photomultiplier tube
Spot size at sample	Diffraction limited
Samples	
Preparation	ALS user wet lab available
Sample environment	Air, cryostat, high pressure
Experimental techniques	UV-visible photoluminescence
Local contact	Name: Joel W. Ager Phone: (510) 486-6715 Fax: (510) 486-4114 Email: jwager@lbl.gov
Spokesperson	Name: Eugene E. Haller Affiliation: Materials Sciences Division, Berkeley Lab; Univ. of California, Berkeley Phone: (510) 486-5294 Fax: (510) 486-5530 Email: eehaller@lbl.gov
Beamline phone number	(510) 495-2014

Beamline 1.4.2

Visible and Infrared Fourier Transform Spectroscopy (FTIR)

Operational	Now
Source characteristics	Bend magnet
Energy range	0.002–3 eV
Frequency range	15–25,000 cm^{-1}
Interferometer resolution	0.125 cm^{-1}
Endstations	Bruker IFS66v/S FTIR (vacuum)
Characteristics	Rapid- and step-scan FTIR, down to 5-ns time resolution, reflection and transmission modes
Spatial resolution	Diffraction limited (~ wavelength)
Detectors	Silicon bolometer (LHe cooled) Wide-range MCT (mercury cadmium telluride) Gap diode Silicon diode Fast silicon diode DTGS mid-IR DTGS far-IR
Spot size at sample	1 mm (varies with coupling optics)
Samples	
Preparation	Stereo microscope and table, KBr press, IR cards, ALS user wet and biological labs available
Sample environment	Air or 10^{-2} Torr in main FTIR bench sample compartment. LHe cryostat available for sample temperatures of 2-475 K. Chopped Ar laser available via fiber optic for photoexcitation.
Scientific applications	Strongly correlated systems, submonolayers on surfaces, polymers, semiconductors, superconductors, environmental samples, forensic studies, etc.
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Beamline 1.4.3
Infrared Spectromicroscopy

Operational	Now
Source characteristics	Bend magnet
Energy range	0.05–1 eV
Frequency range	550–10,000 cm^{-1}
Interferometer resolution	0.125 cm^{-1}
Endstations	Nicolet Magna 760 FTIR, Nic-Plan IR microscope (N_2 purged)
Characteristics	Motorized sample stage, micron resolution, reflection and transmission modes
Spatial resolution	Diffraction limited (~ wavelength)
Detectors	Extended-range MCT (mercury cadmium telluride)
Spot size at sample	< 10 µm (diffraction limited)
Samples	
Preparation	Stereo microscope, table, ALS user wet and biological labs available
Sample environment	N_2 purged, minimal clean area (no particle specification), heater/cooler stage available for 70–730 K
Scientific applications	Biological systems, forensic studies, laminates, polymers, fibers, environmental samples, particulate contamination
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Beamline 3.1
Diagnostic Beamline

Operational	Now
Source characteristics	Bend magnet
Energy range	1–2 keV transmission through thin-film carbon filter
Endstations	Optical diagnostics table with streak camera
Characteristics	1:1 focusing of beam image
Spatial resolution	1–2 μm transverse resolution, 1–2 ps timing resolution
Detectors	Back-thinned CCD camera, dual sweep synchroscan streak camera
Scientific applications	Storage ring diagnostics, accelerator physics
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Beamline 3.3.1

Commercial Deep-Etch X-Ray Lithography (LIGA)

Operational	Now
Source characteristics	Bend magnet
Energy range	3–12 keV
Monochromator	None
Endstations	Hutch with automated scanner
Calculated spot size at sample	100 x 10 mm
Samples	
Format	3- and 4-in. wafer format; x-ray mask and LIGA substrate
Sample environment	Ambient, air
Scientific applications	Deep-etch x-ray lithography (LIGA)
Local contact	Name: Cheryl Hauck Phone: (510) 486-7885 Fax: (510) 486-4102 Email: cahauck@lbl.gov
Spokesperson	Name: Dale Boehme Affiliation: AXSUN Technologies Inc. Phone: (925) 373-3174, ext. 102 Fax: (925) 373-3178 Email: dboehme@axsun.com
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Beamline 3.3.2
Deep-Etch X-Ray Lithography (LIGA)

Operational	Now
Source characteristics	Bend magnet
Energy range	1–20 keV (Be low-energy cutoff filter)
Monochromator	None
Calculated flux (1.9 GeV, 400 mA)	2.7 x 10^{13} photons/s/0.1%BW
Endstations	Small hutch with wafer scanner
Calculated beam dimensions at sample	109.4 mm x 11.6 mm
Scientific applications	Research and development on deep-etch x-ray lithography such as LIGA (micromachining of high-aspect-ratio microstructures)
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Beamline 4.0.2
Magnetic Spectroscopy

Operational	Now
Source characteristics	5.0-cm-period elliptical polarization undulator (EPU5)
Energy range	52–1900 eV; minimum energy polarization dependent
Monochromator	Variable-included-angle PGM
Calculated flux (1.9 GeV, 400 mA)	1×10^{13} photons/s/0.1%BW at 800 eV [Value reported is the merit function flux = total flux x (degree of circular polarization)^2.]
Resolving power (E/ΔE)	5,000–10,000 at source size limit; energy-dependent > 25,000 at 64 eV, 10-yμm entrance/exit slits
Special notes	Polarization is user selectable; linear polarization continously variable from horizontal to vertical; left and right elliptical (or circular) polarization
Endstations	XMCD Chamber X-Ray Absorption Chamber Advanced Photoelectron Spectrometer/Diffractometer Gas-Phase Absorption Cell Spin Spectrometer MXCD Cryo-Chamber L-Edge Chamber with Superconducting Spectrometer XMCD Chamber (6 T, 2 K) Photoemission Electron Microscope
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Beamline 4.0.2

Magnetic Spectroscopy

XMCD Chamber

Characteristics	UHV chamber with an external electromagnet
Spatial resolution	None
Detectors	Sample current
Spot size at sample	1 mm (h) x 0.1 mm (v) , larger if defocused
Samples	
Format	Up to 1 x 1 cm
Preparation	None
Sample environment	UHV, liquid N_2 to room temperature
Special notes	Electromagnet: 0.25 Tesla
Scientific applications	Spectroscopy on ferromagnetic and antiferromagnetic materials
Experimental techniques	NEXAFS, XMCD, XMLD
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Beamline 4.0.2

Magnetic Spectroscopy

X-Ray Absorption Chamber

Characteristics	Two positions for UHV or HV samples
Spatial resolution	None
Detectors	Total electron yield
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Any solid sample
Sample environment	10^{-9} Torr or < 10^{-3} Torr behind a thin window
Special notes	Sample manipulator accommodates multiple samples; transmission experiments also possible
Scientific applications	XANES, EXAFS; MCD or MLD on samples with remanent magnetic field
Experimental techniques	Soft x-ray absorption
Local contacts	Name: Anthony T. Young Phone: (510) 486-7746 Fax: (510) 486-7696 Email: atyoung@lbl.gov Name: Elke Arenholz Phone: (510) 486-4834 Fax: (510) 486-7588 Email: earenholz@lbl.gov

Beamline 4.0.2

Magnetic Spectroscopy

Advanced Photoelectron Spectrometer/Diffractometer

Characteristics	Rotatable analysis chamber, two-axis variable-temperature sample goniometer with 3-D translation operating between 150 and 2000 K; new goniometer extending to 10 K in mid-2002
Spatial resolution	10,000 ±1.5° or ±6°
Detectors	Scienta ES 200 electron spectrometer with micro-Mott spin detector (now) and Scienta XES 300 x-ray emission spectrometer (early 2002)
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	UHV-compatible solids up to 10 mm diameter and 1–2 mm thick
Preparation	Knudsen-cell thin-film evaporation, ion sputtering, annealing, LEED, loadlock sample insertion, in situ cleaving and magnetization
Sample environment	UHV, approximately 1 to 2 x 10^{-10} Torr
Special notes	Flexible and user-friendly control system; two detectors mounted on a rotatable carousel enabling changes in ~ 30 min. without breaking UHV
Scientific applications	Electronic and magnetic properties at surfaces and interfaces, atomic and magnetic structures near surfaces and at buried interfaces, structural and magnetic phase transitions
Experimental techniques	High-resolution, angle-resolved photoelectron spectroscopy, diffraction and holography; x-ray asborption and x-ray emission spectroscopy
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Beamline 4.0.2

Magnetic Spectroscopy

Gas-Phase Absorption Cell

Characteristics	15-cm pathlength enclosed by thin windows, flowing or static sample
Spatial resolution	None
Detectors	Total ion current or x-ray transmission
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Any sample with adequate vapor presure
Sample environment	$< 0.1 \times 10^{-3}$ Torr to 5×10^{-3} Torr
Scientific applications	Spectroscopy on gas phase systems
Experimental techniques	Soft x-ray absorption
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Beamline 4.0.2

Magnetic Spectroscopy

Spin Spectrometer

Characteristics	Spin- and angle-resolved photoemission and absorption
Spatial resolution	None
Detectors	MCD hemispherical analyzer with spin- and angle-resolving capability
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Magnetic solids, thin films, and multilayers
Preparation	Sputter annealing and in situ deposition
Sample environment	UHV, 150–1200 K
Special notes	360° angle-resolving analyzer with 2° angular resolution
Scientific applications	Polarization-dependent photoemission and x-ray absorption spectroscopies of advanced magnetic materials, half metals, nanostructures, and thin films
Experimental techniques	MXCD, SPXPS, SPUPS, MLDAD, AES, XPS, UPS, LEED, ARPES, ARSPUPS
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Beamline 4.0.2
Magnetic Spectroscopy
MXCD Cryo-Chamber

Characteristics	Closed-cycle cryostat-based system for MXCD and MLDAD at temperatures down to 16 K in static or alternating magnetic fields
Spatial resolution	None
Detectors	Picoammeter drain current
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Magnetic solids
Preparation	In-situ cleaving of single-crystal samples
Sample environment	UHV, 16–400 K
Special notes	Sample magnetization by rare-earth permanent magnets or pulsed magnetic coils
Scientific applications	Magnetic spectroscopy of advanced single-crystal magnetic materials with low Curie temperatures or low remanence
Experimental techniques	MXCD, MLDAD, x-ray absorption
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Beamline 4.0.2

Magnetic Spectroscopy

L-Edge Chamber with Superconducting Spectrometer

Spatial resolution	None
Detectors	Nine-element array superconducting tunnel junction fluorescence detector; sample current
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Dried protein films, powders, thin films
Preparation	Proteins dried on Al_2O_3 disks, often in inert atmosphere; model compounds usually as powder on carbon tape
Sample environment	UHV (10^{-8} to 10^{-9} Torr), cooling down to ~15 K possible
Special notes	Also analysis of wet and/or air- sensitive samples
Scientific applications	Active sites in metalloproteins, enzymatic mechanisms
Experimental techniques	Fluorescence-detected absorption spectroscopy
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Beamline 4.0.2

Magnetic Spectroscopy

XMCD Chamber (6 T, 2 K)

Characteristics	6-Tesla superconducting magnet, 2 K sample temperature
Spatial resolution	None
Detectors	30-element germanium fluorescence detector; sample current
Spot size at sample	1 mm (h) x 0.1 mm (v), larger if defocused
Samples	
Format	Solids, powders, dried liquid films up to 5 x 5 mm
Sample environment	UHV
Scientific applications	Spectroscopy on proteins and model compounds
Experimental techniques	XMCD, L-edge spectroscopy
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Beamline 4.0.2

Magnetic Spectroscopy

Photoemission Electron Microscope

Spatial resolution	80 nm
Detectors	Photoemission electron microscope (PEEM)
Spot size at sample	90 x 60 µm
Samples	
Format	Single crystals and thin films grown in situ (metals and oxides), sample transfer from air through load-lock; maximum sample size 10 x 10 x 2 mm
Preparation	Ion bombardment, annealing, oxidation, magnetization
Sample environment	UHV
Special notes	Sample preparation chamber for in-situ growth; I_0 chamber with 20-µm slits for XAS, XMCD, and XMLD
Scientific applications	Investigations of magnetic nanostructures
Experimental techniques	PEEM, XAS, XMCD, XMLD, MOKE, LEED, AES
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Beamline 4.2.2

Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography

Operational	2002
Source characteristics	Superbend
Energy range	6–18 keV
Monochromator	Double crystal
Calculated flux (1.9 GeV, 400 mA)	2.4 x 10^{11} photons/s at 12 keV
Resolving power (E/ΔE)	7000 with Si(111) crystals
Endstations	Minihutch
Detectors	Bruker Proteum 3-cm round lens-coupled CCD system
Spot size at sample (FWHM)	65 x 150 µm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available; most samples pre-frozen
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Molecular biology; multiple-wavelength anomalous diffraction (MAD), monochromatic protein crystallography
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Beamline 5.0.1
Monochromatic Protein Crystallography

Operational	Now
Source characteristics	16-cm-period wiggler (W16) (38 poles, 19 periods)
Energy range	12.4 keV
Monochromator	Single crystal, cylindrically bent, Si(220)
Calculated flux (1.9 GeV, 400 mA)	8.5 x 10^{13} photons/s/0.1%BW at 12 keV (energy dependent)
Resolving power (E/ΔE)	~15,000
Endstations	Macromolecular Crystallography Facility
Detectors	ADSC Quantum 4U CCD
Spot size at sample (FWHM)	0.7 (h) x 0.15 (v) mm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; monochromatic
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Beamline 5.0.2

Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography

Operational	Now
Source characteristics	16-cm-period wiggler (W16) (38 poles, 19 periods)
Energy range	3.5–14 keV
Monochromator	Double-crystal Si(111)
Calculated flux (1.9 GeV, 400 mA)	2.3 x 10^{13} photons/s/0.1%BW into 1.5 mrad at 12.4 keV
Resolving power (E/ΔE)	10,000 for Si(111)
Endstations	Macromolecular Crystallography Facility
Characteristics	Single-axis, air-bearing goniometer; CCD detector, low-temperature system
Detectors	2 x 2 array CCD (ADSC)
Spot size at sample (FWHM)	0.8 (h) x 0.4 (v) mm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; multiple-wavelength anomalous diffraction (MAD), monochromatic
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Beamline 5.0.3
Monochromatic Protein Crystallography

Operational	Now
Source characteristics	16-cm-period wiggler (W16) (38 poles, 19 periods)
Energy range	12.4 keV
Monochromator	Asymmetrically cut Si(220) crystal, cylindrically bent
Calculated flux (1.9 GeV, 400 mA)	8.5 x 10^{13} photons/s/0.1%BW at 12 keV (energy dependent)
Resolving power (E/ΔE)	15,000
Endstations	Macromolecular Crystallography Facility
Detectors	2 x 2 array ADSC Quantum 4 CCD detector
Spot size at sample (FWHM)	0.7 (h) x 0.15 (v) mm; 50-µm, 100-µm, and 100-µm collimator
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available; automated sample mounting system
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; monochromatic
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Beamline 5.3.1
Femtosecond Phenomena

Operational	Now
Source characteristics	Bend magnet
Energy range	1.8–12 keV (monochromatic)
Monochromator	White light and monochromatic (double crystal), with Si(111), Ge(111), or InSb(111) crystals
Calculated flux (1.9 GeV, 400 mA)	~1 x 10^{12} photons/s/3x10^{-4}BW
Resolving power (E/ΔE)	1200 at 5000 eV
Detectors	Picosecond streak camera and avalanche photodiode
Spot size at sample	100 x 300 µm1
Samples	
Format	Crystals, liquid jets, foils
Sample environment	10^{-6} Torr vacuum or helium
Experimental techniques	Laser-/electron-beam modulation, time-resolved (subpicosecond) x-ray diffraction and absorption
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Beamline 5.3.2
Polymer Scanning Transmission X-Ray Microscopy

Operational	Now
Source characteristics	Bend magnet
Energy range	150–650 eV
Monochromator	Low-dispersion, spherical-grating monochromator, one grating
Calculated flux (1.9 GeV, 400 mA)	1×10^6 photons/s at sample
Resolving power (E/ΔE)	3000
Endstations	Scanning transmission x-ray microscope (STXM)
Characteristics	Servo-stabilized collecting mirror
Spot size at sample (FWHM)	50 nm
Experimental techniques	Serves user group and independent investigators using dedicated polymer STXM for NEXAFS spectromicroscopy at the C, N, and O K edges
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Spokesperson	Name: Harald W. Ade Affiliation: North Carolina State University Phone: (510) 486-5738 Fax: (510) 486-7588 Email: harald_ade@ncsu.edu
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Beamline 6.1.2
High-Resolution Zone-Plate Microscopy

Operational	Now
Source characteristics	Bend magnet
Energy range	300–900 eV
Monochromator	Zone-plate linear
Calculated flux (1.9 GeV, 400 mA)	Images with 1000 x 1000 pixels, 1000 photons/pixel recorded in 3 s at 517 eV, 0.2%BW
Resolving power (E/ΔE)	500–700
Endstations	X-ray microscope (XM-1)
Characteristics	Full-field soft x-ray microscope
Spatial resolution	25 nm
Detectors	Back-thinned CCD camera
Field of view	10 µm single field; larger areas can be tiled together like a mosaic
Samples	
Format	Thin samples (up to 10 µm thick) on silicon nitride or other foils, wet chamber provided
Preparation	Sample dependent
Sample environment	Helium at atmospheric pressure, wet or dry, low temperature (cryo)
Special notes	Mutual indexing system with visible-light microscopy provided to position and focus sample
Scientific applications	Transmission x-ray imaging for biology, magnetic materials, environmental sciences, material sciences, polymers
Local contacts	Name: Angelic Pearson Phone: (510) 486-4079 Fax: (510) 486-4550 Email: alpearson@lbl.gov Name: Gerd Schneider Phone: (510) 486-7052 Email: grschneider@lbl.gov
Spokesperson	Name: Gregory Denbeaux Affiliation: Center for X-Ray Optics, Berkeley Lab Phone: (510) 486-4051 Fax: (510) 486-4550 Email: gpdenbeaux@lbl.gov
Beamline phone number	(510) 495-2061

Beamline 6.3.1

Calibration and Standards, EUV/Soft X-Ray Optics Testing, Solid-State Chemistry

Operational	Now
Source characteristics	Bend magnet
Energy range	500–2000 eV
Monochromator	VLS-PGM
Calculated flux (1.9 GeV, 400 mA)	10^{11} photons/s/0.01%BW at 1000 eV
Resolving power (E/ΔE)	5000
Endstations	Reflectometer
Characteristics	VLS-PGM monochromator with fixed exit slit and refocusing mirror; 2-circle goniometer with x, y, z, θ sample mirror; can position to 1 µm
Detectors	Si diode, CEM, MCP, total yield
Spot size at sample	5 x 200 µm
Samples	
Format	Solid state, gas phase; foils, powders, etc.
Sample environment	High vacuum or UHV
Scientific applications	Solid-state chemistry to the Al and Si K edges, atomic physics reflectometry, scattering
Local contact/spokesperson	Name: Rupert Perera Affiliation: Center for X-Ray Optics, Berkeley Lab Phone: (510) 486-5680 Fax: (510) 486-7696 Email: rcperera@lbl.gov
Beamline phone number	(510) 495-2062

Beamline 6.3.2

Calibration and Standards; EUV Optics Testing; Atomic, Molecular, and Materials Science

Operational	Now
Source characteristics	Bend magnet
Energy range	50–1300 eV
Monochromator	VLS-PGM
Calculated flux (1.9 GeV, 400 mA)	10^{11} photons/s/0.01%BW at 100 eV
Resolving power (E/ΔE)	7000
Endstations	Reflectometer
Characteristics	2-circle goniometer with x, y, z, θ movement of sample
Spatial resolution	Can position to 1 µm, 0.002°
Detectors	Photodiode, channeltron, and CCD camera on a rotating arm
Spot size at sample	10 (v) x 300 (h) µm
Samples	
Format	Solid state, gas phase; foils, powders, films up to 20 cm in diamter
Sample environment	High vacuum or UHV
Scientific applications	Solid-state chemistry, gas phase, atomic physics reflectometry, scattering
Local contacts	Name: Stan Mrowka Phone: (510) 486-4131 Fax: (510) 486-4550 Email: smrowka@lbl.gov Name: Andy Aquila Phone: (510) 495-2063 Fax: (510) 486-4955 Email: alaquila@lbl.gov
Spokesperson	Name: Eric Gullikson Affiliation: Center for X-Ray Optics, Berkeley Lab Phone: (510) 486-6646 Fax: (510) 486-4550 Email: emgullikson@lbl.gov
Beamline phone number	(510) 495-2063

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

Operational	Now
Source characteristics	5-cm-period undulator (U5) (first, third, and fifth harmonics)
Energy range	See endstation tables
Monochromator	See endstation tables
Endstations	Scanning Photoemission Microscope (SPEM) Scanning Transmission X-Ray Microscope (STXM) Spin-Resolved Endstation (SPIN) UltraESCA Soft X-Ray Fluorescence Spectrometer (SXF)
Beamline phone numbers	(510) 495-2070, (510) 495-2071, (510) 495-2079

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

Scanning Photoemission Microscope (SPEM)

Characteristics	Designed for submicron XPS
Energy range	100–800 eV
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	10^8–10^9 photons/s/0.01%BW
Resolving power (E/ΔE)	3000
Spatial resolution	Scanning microscope with focusing by means of Fresnel zone plates; resolution determined by spot size, which is 150 nm with current zone plates but will improve with new zone plates
Detectors	Hemispherical electron energy analyzer; total electron yield detector
Spot size at sample	150 nm with current zone plates
Samples	
Format	UHV-compatible solids up to 25 mm in diamter
Preparation	Preparation chamber with sputtering and annealing provided
Sample environment	UHV
Special notes	Optical alignment equipment provided so that visible marks on the sample surface can be used to find an area of interest prior to x-ray measurements; in-situ heating and cooling
Experimental techniques	XPS, NEXAFS, imaging of areas up to 100 µm across
Local contact	Name: Tony Warwick Phone: (510) 486-5819 Fax: (510) 486-7696 Email: t_warwick@lbl.gov
Spokesperson	Name: James Tobin Affiliation: Lawrence Livermore National Laboratory Phone: (925) 422-7247 Fax: (925) 423-7040 Email: tobin1@llnl.gov

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

Scanning Transmission X-Ray Microscope (STXM)

Characteristics	Used to make x-ray images and NEXAFS spectra of thin samples in transmission
Energy range	180–900 eV
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	~10^7 photons/s/0.01%BW
Resolving power (E/ΔE)	3000 (typical), 5000 (optimized)
Spatial resolution	Scanning microscope with focusing by means of Fresnel zone plates; resolution determined by spot size, which is 100 nm with current zone plates but will improve with new zone plates
Detectors	Photon-counting detector behind the sample records the intensity of the transmitted radiation, generating an image pixel by pixel during the rastering
Spot size at sample	100 nm with current zone plates
Samples	
Format	Thin sections or films (100 nm thick), 3 x 3 mm in area
Preparation	No preparation chamber available
Sample environment	Helium at 1 atm
Special notes	Samples may be wet or dirty; thin films may be deposited on silicon nitride windows; optical alignment is provided by looking at the back side of the sample to locate regions of interest from optical micrographs
Experimental techniques	Imaging, NEXAFS in small spots
Local contact	Name: Tony Warwick Phone: (510) 486-5819 Fax: (510) 486-7696 Email: t_warwick@lbl.gov
Spokesperson	Name: James Tobin Affiliation: Lawrence Livermore National Laboratory Phone: (925) 422-7247 Fax: (925) 423-7040 Email: tobin1@llnl.gov

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

Spin-Resolved Endstation (SPIN)

Characteristics	Spin- and angle-resolved XPS spectroscopy; x-ray linear dichroism measurement
Energy range	60–1200 eV
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	~10^{12} photons/s/0.01%BW (resolution dependent)
Resolving power (E/ΔE)	≤ 8000
Spatial resolution	100 µm – 4 mm
Detectors	Hemispherical electron energy analyzer with Mini-Mott detector
Spot size at sample	~200 µm
Samples	
Format	UHV-compatible solids up to 12 mm in diameter
Preparation	In-situ sputtering, sample heating and cooling (LN_2) available
Sample environment	UHV; sample-transfer system allows introduction of samples without venting chamber
Experimental techniques	XPS, spin-resolved XPS, XMLDAD
Local contact	Name: Michael Hochstrasser Phone: (510) 486-5584 Fax: (510) 486-7588 Email: mhochstrasser@lbl.gov
Spokesperson	Name: James Tobin Affiliation: Lawrence Livermore National Laboratory Phone: (925) 422-7247 Fax: (925) 423-7040 Email: tobin1@llnl.gov

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

UltraESCA

Characteristics	High-resolution, angle-resolved XPS spectroscopy; capable of making images by rastering the sample through a fixed spot; sample is rotated for angle-resolved measurements
Energy range	60–1200 eV
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	~10^{12} photons/s/0.01%BW (resolution dependent)
Resolving power (E/ΔE)	≤ 8000
Spatial resolution	100 µm – 4 mm
Detectors	Hemispherical electron energy analyzer; total electron yield detector
Spot size at sample	50 µm
Samples	
Format	UHV-compatible solids up to 25 mm in diameter
Preparation	Preparation chamber with sputtering is provided
Sample environment	UHV
Special notes	LEED and in-situ sample heating and cooling available
Scientific applications	Condensed matter science, surface science
Experimental techniques	XPS, XPD, NEXAFS
Local contact	Name: Eli Rotenberg Phone: (510) 486-5975 Fax: (510) 486-7696 Email: erotenberg@lbl.gov
Spokesperson	Name: James Tobin Affiliation: Lawrence Livermore National Laboratory Phone: (925) 422-7247 Fax: (925) 423-7040 Email: tobin1@llnl.gov

Beamline 7.0.1

Surface and Materials Science, Spectromicroscopy, Spin Resolution, Photon-Polarization Dichroism

Soft X-Ray Fluorescence Spectrometer (SXF)

Characteristics	Grating spectrometer for high-resolution (1:3000) photon-in/photon-out spectroscopy
Energy range	50–1200 eV
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	3 x 10^{12} photons/s/0.01%BW (at 800 eV)
Resolving power (E/ΔE)	1800 (at 800 eV)
Detectors	Channel-plate photon counter in spectrometer focal plane
Spot size at sample	50 µm
Samples	
Format	Solids or gases in windowed cell
Preparation	No preparation chamber provided
Sample environment	UHV
Special notes	This spectrometer is installed by the group from the University of Uppsala, Sweden. Potential users are asked to contact Professor Nordgren to explore possible collaborations.
Experimental techniques	Photon-in/photon-out spectroscopy
Local contact	Name: Jinghua Guo Phone: (510) 495-2230 Email: jguo@lbl.gov
Spokesperson	Name: Joseph Nordgren Affiliation: Uppsala University, Sweden Phone: 46-18-471-3554 Fax: 46-18-471-3524 Email: joseph@fysik.uu.se

Beamline 7.3.1.1
Magnetic Microscopy, Spectromicroscopy

Operational	Now
Source characteristics	Bend magnet
Energy range	175–1500 eV
Monochromator	SGM
Calculated flux (1.9 GeV, 400 mA)	3 x 10^{12} photons/s/0.01%BW at 800 eV (linearly polarized)
Resolving power (E/ΔE)	1800 at 800 eV
Endstations	Photoemission electron microscope (PEEM2)
Characteristics	Imaging of electron emission
Spatial resolution	Better than 50 nm depending on sample; 100 nm typical
Detectors	Slow scan CCD
Spot size at sample	≤ 30 x 30 μm
Samples	
Format	UHV-compatible solids up to 1 cm^2 in area
Preparation	Sputtering, heating, evaporation, LEED, transfer capability, magnet (100 Oe)
Sample environment	UHV
Special notes	Choice of linearly or circularly polarized radiation (flux of circularly polarized radiation is reduced)
Scientific applications	Real-time study of elemental, chemical, magnetic, and topographical properties of materials
Local contact	Name: Andreas Scholl Phone: (510) 486-4867 Fax: (510) 495-2111 Email: a_scholl@lbl.gov
Spokesperson	Name: Joachim Stöhr Affiliation: Stanford Synchrotron Radiation Laboratory Phone: (650) 926-2570 Fax: (650) 926-4100 Email: stohr@ssrl.slac.stanford.edu
Beamline phone number	(510) 495-2073

Beamline 7.3.1.2

Surface and Materials Science, Micro X-Ray Photoelectron Spectroscopy

Operational	Now
Source characteristics	Bend magnet
Energy range	175–1500 eV
Monochromator	SGM
Calculated flux (1.9 GeV, 400 mA)	1 x 10^{10} photons/s/0.01%BW at 800 eV
Resolving power (E/ΔE)	1800 at 800 eV
Endstations	MicroXPS
Characteristics	X-ray photoelectron spectroscopy study of 50 x 50 mm sample with 1 x 1 µm spot size
Spatial resolution	1 x 1 µm
Detectors	Electron energy analyzer
Spot size at sample	1 x 1 µm
Samples	
Format	UHV-compatible solids up to 50 x 50 mm
Preparation	Heating, sputtering
Sample environment	UHV
Special notes	In-vacuum fiducialization of sample using optical visible-light microscope; high-precision x-y stage; laser interferometer encoding
Scientific applications	Study of microstructures and interfaces in integrated circuits
Experimental techniques	MicroXPS, NEXAFS, MCD
Local contact	Name: Glenn Ackerman Phone: (510) 486-7886 Fax: (510) 486-7696 Email: gdackerman@lbl.gov
Spokesperson	Name: Dick Brundle Affiliation: Applied Materials, Inc. Phone: (408) 294-3353 Email: Dick_Brundle@amat.com
Beamline phone number	(510) 495-2072

Beamline 7.3.3
X-Ray Microdiffraction

Operational	Now
Source characteristics	Bend magnet
Energy range	6–12 keV
Monochromator	White light and monochromatic [two- and four-crystal Ge(111)]
Calculated flux (1.9 GeV, 400 mA)	At typically 8.5 keV: 1 x 10^9 photons/s/μm^2/3x10^{-4}BW (1 x 1 µm spot) 1 x 10^{12} photons/s/3x10^{-4}BW (100 x 300 µm spot)
Resolving power (E/ΔE)	1000–7000 depending on vertical convergence accepted
Detectors	X-ray CCD, image plate, fluorescence Si(Li) detector
Spot size at sample	100 x 300 µm down to 1 x 1 µm
Samples	
Format	Typically less than 1 cm^2 x 1 mm thick
Sample environment	Typically air
Special notes	Microprobe, white-light, and monochromatic experiments
Scientific applications	Measurement of thin film strain, environmental science
Local contacts/spokespersons	Name: Nobumichi Tamura (x-ray microdiffraction) Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-6189 Fax: (510) 486-7696 Email: ntamura@lbl.gov Name: A.A. MacDowell (hard x-ray technique development) Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-4276 Fax: (510) 486-7696 Email: aamacdowell@lbl.gov
Beamline phone numbers	(510) 495-2075, (510) 495-2076

Beamline 8.0.1

Surface and Materials Science, Imaging Photoelectron Spectroscopy, Soft X-Ray Fluorescence

Operational	Now
Source characteristics	5-cm-period undulator (U5) (first, third, and fifth harmonics)
Energy range	65–1400 eV (1.5 GeV); ~80–1400 eV (1.9 GeV)
Monochromator	SGM (gratings: 150, 380, 925 lines/mm)
Flux (1.9 GeV, 400 mA)	~10^{11} to 6 x 10^{15} photons/s (resolution and energy dependent)
Resolving power (E/ΔE)	< 8000
Endstations	Ellipsoidal-Mirror Electron Energy Analyzer (EMA) Soft X-Ray Fluorescence (SXF) Spectrometer
Beamline phone numbers	(510) 495-2080, (510) 495-2089

Beamline 8.0.1

Surface and Materials Science, Imaging Photoelectron Spectroscopy, Soft X-Ray Fluorescence

Ellipsoidal-Mirror Electron Energy Analyzer (EMA)

Characteristics	Measures 84° of electron emission angles from solid samples with 80-meV resolution
Spot size at sample	100 µm
Samples	
Format	UHV-compatible solids up to 2.5 x 1 cm
Preparation	In-situ resistive heating, ion sputtering, and evaporation
Sample environment	UHV
Special notes	Sample preparation chamber, transfer capabilities
Scientific applications	Condensed matter science, surface science
Experimental techniques	XPS, ARPES, NEXAFS
Local contact	Name: Jonathan Denlinger Phone: (510) 486-5648 Fax: (510) 486-7588 Email: jddenlinger@lbl.gov
Spokesperson	Name: Franz Himpsel Affiliation: University of Wisconsin-Madison Phone: (608) 263-5590 Fax: (608) 263-2334 Email: himpsel@comb.physics.wisc.edu

Beamline 8.0.1

Surface and Materials Science, Imaging Photoelectron Spectroscopy, Soft X-Ray Fluorescence

Soft X-Ray Fluorescence (SXF) Spectrometer

Characteristics	Measures the soft x-ray emission from solid samples with a dispersive grating spectrometer
Spot size at sample	100 (h) x 50 to 3000 (v) µm
Samples	
Format	UHV-compatible solids up to 2 cm in diameter; 5-mm diameter
Sample environment	UHV
Special notes	Sample transfer capabilities
Experimental techniques	SXF, NEXAFS, fluorescence-yield XAS of solids
Local contact	Name: Jonathan Denlinger Phone: (510) 486-5648 Fax: (510) 486-7588 Email: jddenlinger@lbl.gov
Spokesperson	Name: Thomas Callcott Affiliation: University of Tennessee Phone: (865) 974-8944 Fax: (865) 974-3949 Email: tcallcott@utk.edu

Beamline 8.2.1

Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography

Operational	Now
Source characteristics	Superbend (single pole)
Energy range	6–18 keV
Monochromator	Double-crystal Si(111)
Measured flux (1.9 GeV, 400 mA)	8 x 10^{10} photons/s through 100-µm pinhole at 12.4 keV
Resolving power (E/ΔE)	7000
Divergence	1.5 mrad (h) x 0.35 mrad (v)
Endstations	Minihutch
Detectors	ADSC Quantum 210 2 x 2 CCD array
Calculated spot size at sample (FWHM)	140 x 150 µm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; multiple-wavelength anomalous diffraction (MAD), monochromatic protein crystallography
Local contacts	Name: George Meigs Phone: (510) 495-2249 Fax: (510) 486-5664 Email: gmeigs@lbl.gov Name: Thomas Earnest Phone: (510) 486-4603 Fax: (510) 486-5664 Email: tnearnest@lbl.gov
Spokesperson	Name: Brian Matthews Affiliation: University of Oregon Phone: (541) 346-2572 Fax: (541) 346-5870 Email: brian@uoxray.uoregon.edu
Beamline phone number	(510) 495-2081

Beamline 8.2.2

Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography

Operational	2002
Source characteristics	Superbend (single pole)
Energy range	6–18 keV
Monochromator	Double-crystal Si(111)
Measured flux (1.9 GeV, 400 mA)	5.7 x 10^{11} photons/s through 100-µm pinhole at 12.4 keV
Resolving power (E/ΔE)	7000
Divergence	1.5 mrad (h) x 0.31 mrad (v)
Endstations	Minihutch
Detectors	ADSC Quantum 315 3 x 3 CCD array
Calculated spot size at sample (FWHM)	65 x 150 µm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; multiple-wavelength anomalous diffraction (MAD), monochromatic protein crystallography
Local contacts	Name: George Meigs Phone: (510) 495-2249 Fax: (510) 486-5664 Email: gmeigs@lbl.gov Name: Thomas Earnest Phone: (510) 486-4603 Fax: (510) 486-5664 Email: tnearnest@lbl.gov
Spokesperson	Name: Brian Matthews Affiliation: University of Oregon Phone: (541) 346-2572 Fax: (541) 346-5870 Email: brian@uoxray.uoregon.edu
Beamline phone number	(510) 495-2082

Beamline 8.3.1

Multiple-Wavelength Anomalous Diffraction (MAD) and Monochromatic Protein Crystallography

Operational	Now
Source characteristics	Superbend
Energy range	2.4–15 keV
Monochromator	Double crystal
Calculated flux (1.9 GeV, 400 mA)	5.7 x 10^{11} photons/s (100 µm collimator)
Resolving power (E/ΔE)	7000
Endstations	Minihutch
Detectors	2 x 2 array CCD (ADSC)
Calculated spot size at sample (FWHM)	65 x 150 µm
Samples	
Format	Single crystals of biological molecules
Preparation	Support labs available
Sample environment	Ambient or ~100 K
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; multiple-wavelength anomalous diffraction (MAD), monochromatic protein crystallography
Local contact	Name: James Holton Phone: (510) 486-4587 Email: jmholton@lbl.gov
Spokespersons	Name: Tom Alber Affiliation: University of California, Berkeley Phone: (510) 642-8758 Fax: (510) 643-9290 Email: tom@ucxray6.berkeley.edu Name: James Berger Affiliation: University of California, Berkeley Phone: (510) 643-9483 Fax: (510) 643-9290 Email: jmberger@uclink4.berkeley.edu
Beamline phone numbers	(510) 495-2083, (510) 495-2085

Beamline 8.3.2
Tomography

Operational	2003
Source characteristics	Superbend
Energy range	3–60 keV
Monochromator	Double crystal: Si 111 and multilayer
Calculated flux (1.9 GeV, 400 mA)	700 at 10 keV, 150 at 30 keV, and 50 at 40 keV in units of photons/s/μm^2/actual bandwidth over a 0.6 x 6 cm area
Resolving power (E/ΔE)	Si 111: 7,000; multilayer: 330
Endstations	Conventional radiography (10–45 keV)
Characteristics	Radiography spatial resolution: ~1 μm
Detectors	Scintillator plus CCD
Spot size at sample (FWHM)	1–6 mm high, 60 mm wide
Samples	
Format	Universal except for the need to fit within the illuminated field
Sample environment	Atmosphere
Experimental techniques	Tomography
Local contact/spokesperson	Name: Malcolm Howells Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-4949 Fax: (510) 486-7696 Email: mrhowells@lbl.gov

Beamline 9.0.1
Coherent Optics/Scattering Experiments

Operational	Now
Source characteristics	10-cm-period undulator (U10)
Energy range	10–800 eV
Monochromator	Either none or an off-axis zone-plate monochromator that will provide a focused beam with bandwith of about 0.1%
Calculated flux (1.9 GeV, 400 mA)	2.8×10^{15} photons/s/1%BW/central cone at 457 eV
Resolving power ($E/\Delta E$)	70 (undulator peak width)
Endstations	General purpose
Detectors	Scintillator plus CCD, photodiode, etc.
Samples	
Format	Various
Preparation	Can be cryo
Sample environment	Clean high vacuum
Special notes	Endstation separated from beamline by cooled window
Experimental techniques	Coherent scattering, holography, diffraction, correlation spectroscopy
Local contact	Name: Malcolm Howells Phone: (510) 486-4949 Fax: (510) 486-7696 Email: mrhowells@lbl.gov
Spokesperson	Name: Stephen Kevan Affiliation: University of Oregon Phone: (541) 346-4742 Fax: (541) 346-3422 Email: kevan@darkwing.uoregon.edu

Beamline 9.0.2

Chemical Reaction Dynamics, Photochemistry, High-Resolution Photoelectron and Photoionization Spectroscopy, Photoelectron and Photoionization Imaging and Spectroscopy

Operational	Now
Source characteristics	10-cm-period undulator (U10) (fundamental)
Energy range	5–30 eV
Monochromator	See endstation tables
Endstations	Crossed Molecular Beam Molecular-Beam Photoelectron/Photoion Imaging and Spectroscopy Molecular-Beam Photoelectron/Photoion Spectroscopy
Beamline phone number	(510) 495-2092

Beamline 9.0.2

Chemical Reaction Dynamics, Photochemistry, High-Resolution Photoelectron and Photoionization Spectroscopy, Photoelectron and Photoionization Imaging and Spectroscopy

Crossed Molecular Beam

Characteristics	Designed for photofragmentation spectroscopy and reactive scattering; two rotatable molecular-beam sources
Monochromator	None
Calculated flux (1.9 GeV, 400 mA)	~10^{16} photons/s/2.5%BW
Resolving power (E/ΔE)	40
Detectors	Time-of-flight spectroscopy by quadrupole mass analyzer
Spot size at sample (calculated)	170 (h) x 50 (v) µm
Samples	
Format	Gas sample
Preparation	Molecular beam, seeded in rare gas
Sample environment	Vacuum ~10^{-6} Torr
Experimental techniques	Photofragmentation spectroscopy, reactive scattering
Local contact/spokesperson	Name: Tomas Baer Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-4754 Fax: (510) 486-5311 Email: tbaer@lbl.gov

Beamline 9.0.2

Chemical Reaction Dynamics, Photochemistry, High-Resolution Photoelectron and Photoionization Spectroscopy, Photoelectron and Photoionization Imaging and Spectroscopy

Molecular-Beam Photoelectron/Photoion Imaging and Spectroscopy

Characteristics	Multipurpose design for photoion and photoelectron imaging and photoelectron/photoion coincidence experiments
Monochromator	Off-plane Eagle
Calculated flux (1.9 GeV, 400 mA)	~10^{14} photons/s/0.1%BW
Resolving power (E/ΔE)	2000
Detectors	Time-of-flight 2-D position-sensitive detectors
Spot size at sample (calculated)	300 (h) x 1000 (v) µm
Samples	
Format	Gas sample
Preparation	Molecular beam, seeded in rare gas Laser ablation source Laser photolysis source Plasma discharge
Sample environment	Vacuum ~10^{-5} Torr
Scientific applications	Spectroscopy and dynamics of clusters, radicals, metastable, and other novel species
Local contact	Name: Darcy Peterka Phone: (510) 495-2207 Fax: (510) 486-5311 Email: t_warwick@lbl.gov
Spokesperson	Name: Tomas Baer Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-4754 Fax: (510) 486-5311 Email: tbaer@lbl.gov

Beamline 9.0.2

Chemical Reaction Dynamics, Photochemistry, High-Resolution Photoelectron and Photoionization Spectroscopy, Photoelectron and Photoionization Imaging and Spectroscopy

Molecular-Beam Photoelectron/Photoion Spectroscopy

Characteristics	Multipurpose design for high-resolution photoelectron spectroscopy and photoelectron/photoion coincidence experiments
Monochromator	Off-plane Eagle
Calculated flux (1.9 GeV, 400 mA)	~10^{11} photons/s/0.01%BW
Resolving power (E/ΔE)	~70,000
Detectors	Time-of-flight and quadrupole ion and pulsed-field ionization electron detector
Spot size at sample (calculated)	360 (h) x 240 (v) µm
Samples	
Format	Gas sample
Preparation	Molecular beam, seeded in rare gas
Sample environment	Vacuum ~10^{-6} Torr
Experimental techniques	Pulsed-field ionization photoelectron spectroscopy, threshold photoelectron/photoion coincidence, state-selected ion-molecule reaction dynamics
Local contact	Name: Tomas Baer Phone: (510) 486-4754 Fax: (510) 486-5311 Email: tbaer@lbl.gov
Spokesperson	Name: Cheuk Ng Affiliation: Univ. of California, Davis Phone: (530) 754-9645 Fax: (530) 752-8995 Email: cyng@chem.ucdavis.edu

Beamline 9.3.1

Atomic, Molecular, and Materials Science

Operational	See endstation tables
Source characteristics	Bend magnet
Energy range	2.2–6.0 keV with Si(111) crystals
Monochromator	Double crystal
Measured flux (1.9 GeV, 400 mA)	> 10^{11} photons/s
Resolving power (E/ΔE)	3000–8000
Endstations	Angle-Resolved Time-of-Flight Electron Spectrometer Ion Time-of-Flight Spectrometer Magnetic Mass Analyzer Polarized-X-Ray Emission Spectrometer (2002) X-Ray Absorption Cell
Beamline phone number	(510) 495-2094

Beamline 9.3.1

Atomic, Molecular, and Materials Science

Angle-Resolved Time-of-Flight Electron Spectrometer

Operational	Now
Characteristics	Timing resolution ~200 ps; chamber rotates about x-ray beam (±100°)
Detectors	5 time-of-flight electron analyzers (0.5 m long)
Spot size at sample	< 0.5 mm
Samples	Gases
Sample environment	Gas-phase flow system
Experimental techniques	Photoelectron and Auger spectroscopy, electron-electron coincidence
Local contacts	Name: Fred Schlachter Phone: (510) 486-4892 Fax: (510) 486-6499 Email: fsschlachter@lbl.gov Name: Wayne Stolte Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov
Spokesperson	Name: Dennis Lindle Affiliation: University of Nevada, Las Vegas Phone: (702) 895-4426 Fax: (702) 895-4072 Email: lindle@nevada.edu

Beamline 9.3.1

Atomic, Molecular, and Materials Science

Ion Time-of-Flight Spectrometer

Operational	Now
Characteristics	Timing resolution ~200 ps; capable of coincidence measurement (ion-ion, ion-ion-ion, electron-ion, electron-ion-ion, etc.)
Detectors	Microchannel plates for ions, channeltron for electrons
Spot size at sample	< 0.5 mm
Samples	Gases
Sample environment	Gas-phase flow system
Experimental techniques	Ion spectroscopy, total and partial ion yields, PIPICO, PEPICO, PEPIPICO, etc.
Local contacts	Name: Fred Schlachter Phone: (510) 486-4892 Fax: (510) 486-6499 Email: fsschlachter@lbl.gov Name: Wayne Stolte Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov
Spokesperson	Name: Dennis Lindle Affiliation: University of Nevada, Las Vegas Phone: (702) 895-4426 Fax: (702) 895-4072 Email: lindle@nevada.edu

Beamline 9.3.1

Atomic, Molecular, and Materials Science

Magnetic Mass Analyzer

Operational	Now
Characteristics	Measures mass-to-charge ratios up to 40 (60 if short scan); resolution of 1/50
Detectors	Dr. Sjuts channel electron multiplier
Spot size at sample	1–2 mm
Samples	Gases
Sample environment	Gas-phase flow system
Experimental techniques	Ion/anion spectroscopy
Local contacts	Name: Fred Schlachter Phone: (510) 486-4892 Fax: (510) 486-6499 Email: fsschlachter@lbl.gov Name: Wayne Stolte Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov
Spokesperson	Name: Wayne Stolte Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov

Beamline 9.3.1

Atomic, Molecular, and Materials Science

Polarized X-Ray Emission Spectrometer

Operational	2002
Characteristics	High x-ray energy resolution (E/ΔE ~3000); curved-crystal Rowland-circle spectrometer
Detectors	2-D position-sensitive detector (microchannel plates plus resistive anode)
Spot size at sample	< 0.5 mm
Samples	Gases and solids
Sample environment	Static gas cell with windows, solid samples
Experimental techniques	X-ray emission
Local contacts	Name: Fred Schlachter Phone: (510) 486-4892 Fax: (510) 486-6499 Email: fsschlachter@lbl.gov Name: Wayne Stolte Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov
Spokesperson	Name: Dennis Lindle Affiliation: University of Nevada, Las Vegas Phone: (702) 895-4426 Fax: (702) 895-4072 Email: lindle@nevada.edu

Beamline 9.3.1

Atomic, Molecular, and Materials Science

X-Ray Absorption Cell

Operational	Now
Detectors	Photodiode/current from plate
Spot size at sample	1–2 mm
Samples	Gases
Sample environment	UHV, gas cell
Experimental techniques	NEXAFS
Local contacts	Name: Fred Schlachter Phone: (510) 486-4892 Fax: (510) 486-6499 Email: fsschlachter@lbl.gov Name: Wayne Stolte Phone: (510) 486-5804 Fax: (510) 495-2111 Email: wcstolte@lbl.gov
Spokesperson	Name: Dennis Lindle Affiliation: University of Nevada, Las Vegas Phone: (702) 895-4426 Fax: (702) 895-4072 Email: lindle@nevada.edu

Beamline 9.3.2

Chemical and Materials Science, Circular Dichroism, Spin Resolution

Operational	Now
Source characteristics	Bend magnet
Energy range	30–1400 eV
Monochromator	SGM (gratings: 100, 600, 1200 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	~10^{11} photons/s/0.1%BW at 400 eV
Resolving power (E/ΔE)	3000 typical, 8000 max (with 10-µm slits)
Spatial resolution	0.5 x 1 mm
Endstations	Advanced Materials Chamber (AMC) Ambient Pressure Photoemission
Beamline phone numbers	(510) 495-2093, (510) 495-2109

Beamline 9.3.2

Chemical and Materials Science, Circular Dichroism, Spin Resolution

Advanced Materials Chamber (AMC)

Characteristics	Studies of atomic and electronic structure of surfaces; capability for circularly polarized radiation
Detectors	Scienta SES 100 electron energy analyzer
Spot size at sample	0.5 x 1 mm
Samples	
Format	UHV-compatible solids up to 10 mm in diameter
Preparation	Sputtering, evaporation, quartz-crystal oscillator, LEED XPS
Sample environment	UHV, large-gap in-situ magnet, heating up to 2300 K, cooling to 200 K, precision manipulator
Special notes	Sample transfer capability
Experimental techniques	Photoelectron diffraction, XPS, NEXAFS, MCD
Local contact/spokesperson	Name: Nasser Hamdan Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-7633 Email: NMHamdan@lbl.gov

Beamline 9.3.2

Chemical and Materials Science, Circular Dichroism, Spin Resolution

Ambient Pressure Photoemision

Characteristics	Photoemission spectroscopy at pressures up to 10 Torr
Detectors	PHI analyzer, 16-element multichannel detector with differentially pumped electron-transfer-lens system
Spot size at sample	0.5 x 1 mm
Samples	
Format	Vacuum-compatible solids up to 10 mm in diameter
Preparation	Sputtering
Sample environment	Gas pressure up to 10 Torr
Experimental techniques	Photoemission spectroscopy at ambient pressure of processes such as catalysis and corrosion, and of environmental and biological systems
Local contact/spokesperson	Name: Nasser Hamdan Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-7633 Email: NMHamdan@lbl.gov

Beamline 10.0.1

Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics

Operational	Now
Source characteristics	10-cm-period undulator (U10) (first and third harmonics)
Energy range	17–340 eV
Monochromator	SGM (gratings: 380, 925, 2100 lines/mm)
Calculated and measured flux (1.9 GeV, 400 mA)	Up to 10^{13} photons/s/0.01%BW (photon energy and resolution dependent)
Resolving power ($E/\Delta E$)	> 10,000 obtained, slit-width selectable
Endstations	High Energy Resolution Spectrometer (HERS) Electron Spin Polarization (ESP) High-Resolution Atomic and Molecular Electron Spectrometer (HiRAMES) Ion-Photon Beamline (IPB)
Beamline phone numbers	(510) 495-2100, (510) 495-2101

Beamline 10.0.1

Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics

High Energy Resolution Spectrometer (HERS)

Characteristics	Designed for very high resolution and angle-resolved photoemission spectroscopy at cryogenic temperatures. The electron energy analyzer rotates 120° about the incoming beam.
Angular resolution	±0.15° or ±0.05°
Detectors	Scienta SES 2002 hemispherical electron energy analyzer with angular mode LEED Partial-yield detector
Spot size at sample	150 (h) x less than 100 (v) µm depending on exit slit setting
Samples	
Format	UHV-compatible solids
Preparation	Sample manipulator with five degrees of freedom and a temperature range of 12-450 K, standard surface-science preparation and characterization equipment
Scientific applications	Studies of highly correlated electron systems
Experimental techniques	Angle-resolved photoemission from solids
Local contact	Name: Xingjiang Zhou Phone: (510) 486-7634 Fax: (510) 486-4299 Email: XJZhou@lbl.gov
Spokesperson	Name: Zhi Xun Shen Affiliation: Stanford University Phone: (650) 725-8254 Fax: (650) 725-5457 Email: zxshen@stanford.edu

Beamline 10.0.1

Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics

Electron Spin Polarization (ESP)

Characteristics	Simultaneous spin-analysis of all electron lines in the time-of-flight spectrum with a high signal-to-noise ratio
Detectors	Three time-or-flight spectrometers (TOFs) mounted at different angles in a vacuum chamber, two with retarding-field Mott polarimeters
Spot size at sample	1.5 (h) x 1.5 (v) mm
Samples	Gas cell
Sample environment	Differential pumping permits gas pressures of up to 10^{-5} Torr
Scientific applications	Measurements of electron spin polarization in free atoms, molecules, and clusters
Local contact	Name: John Bozek Phone: (510) 486-4967 Fax: (510) 486-7696 Email: jdbozek@lbl.gov
Spokesperson	Name: Nora Berrah Affiliation: Western Michigan University Phone: (616) 387-4955 Fax: (616) 387-4939 Email: berrah@wmich.edu

Beamline 10.0.1

Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics

High-Resolution Atomic and Molecular Electron Spectrometer (HiRAMES)

Characteristics	The electron spectrometer uses a gas cell on the beam axis to form the interaction region between the sample and the photon beam. The analyzer rotates from 0° to 90° relative to the photon beam, permitting angle-resolved measurements.
Detectors	Scienta SES 200 electron energy analyzer
Spot size at sample	0.4 (h) x 0.1–0.5 (v) mm depending on exit slit setting
Samples	Gas cell, oven
Sample environment	Windowless differential pumping pemits gas pressures of up to 10^{-5} Torr
Special notes	Vented gas cabinets are available for hazardous samples
Experimental techniques	High-resolution atomic and molecular electron spectroscopy
Local contact	Name: John Bozek Phone: (510) 486-4967 Fax: (510) 486-7696 Email: jdbozek@lbl.gov
Spokesperson	Name: Nora Berrah Affiliation: Western Michigan University Phone: (616) 387-4955 Fax: (616) 387-4939 Email: berrah@wmich.edu

Beamline 10.0.1

Photoemission of Highly Correlated Materials; High-Resolution Atomic, Molecular, and Optical Physics

Ion-Photon Beamline (IPB)

Characteristics	A positively or negatively charged ion beam from an ion accelerator is merged with the photon beam (counter propagating) for approximately 0.5 m. An analyzing magnet disperses the ion beam based on charge state following the interaction region
Detectors	Ion detector
Spot size at sample	1.5 (h) x 1.5 (v) mm
Samples	Beams of singly or multiply charged positive and negative ions
Sample environment	Ion beam target under ultrahigh vacuum conditions
Scientific applications	Photionization of ions: cross-section and excitation spectrum measurements
Local contact	Name: John Bozek Phone: (510) 486-4967 Fax: (510) 486-7696 Email: jdbozek@lbl.gov
Spokespersons	Name: Ronald Phaneuf Affiliation: University of Nevada, Reno Phone: (775) 784-6816 Fax: (775) 784-1398 Email: phaneuf@physics.unr.edu Name: Nora Berrah Affiliation: Western Michigan University Phone: (616) 387-4955 Fax: (616) 387-4939 Email: berrah@wmich.edu

Beamline 10.3.1
X-Ray Fluorescence Microprobe

Operational	Now
Source characteristics	Bend magnet
Energy range	6–15 keV (with multilayer mirrors) 3–20 keV (without multilayer mirrors)
Monochromator	White light, multilayer mirrors in Kirkpatrick-Baez configuration
Calculated flux (1.9 GeV, 400 mA)	3×10^{10} photons/s at 12.5 keV
Resolving power (E/ΔE)	25 at 12.5 keV
Endstations	Large hutch with optical table
Characteristics	X-ray fluorescence analysis of samples with high elemental sensitivity and high spatial resolution
Spatial resolution	1.0 x 1.2 µm
Detectors	Si(Li)
Spot size at sample	1.0 x 1.2 µm
Samples	
Format	Usually flat solids < 2 cm in diameter mounted between two layers of superclean polypropylene
Sample environment	Air
Special notes	By special arrangement, the focusing mirrors can be removed and white-light beam can be used (e.g., testing capillary optics, evaluating x-ray collimators)
Scientific applications	Trace-element analysis with high spatial resolution (e.g., silicon solar cells, GaN, atmospheric particulates, environmental soil samples, and biological samples)
Local contact/spokesperson	Name: Al Thompson Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-5590 Fax: (510) 486-7696 Email: acthompson@lbl.gov
Beamline phone number	(510) 495-2103

Beamline 10.3.2

Environmental and Materials Science, Micro X-Ray Absorption Spectroscopy

Operational	Now
Source characteristics	Bend magnet (beamline optics collect 0.166 horizontal mrad)
Energy range	2.5–17 keV
Monochromator	White light and monochromatic, with Si(111) two-crystal, constant exit monochromator
Calculated flux (1.9 GeV, 400 mA)	1×10^{10} photons/s/0.03%BW into 5-µm spot
Resolving power (E/ΔE)	7000
Endstations	Hutch with optical table
Characteristics	Sample mounted on x-y translation stage
Detectors	Seven-element Ge solid-state detector
Spot size at sample	Adjustable from 3 x 3 µm (slit down) up to 16 x 6 µm (full flux)
Samples	
Format	Solids
Sample environment	Air
Experimental techniques	Custom designed for micro x-ray absorption spectroscopy
Local contact/spokesperson	Name: Matthew Marcus Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-5787 Fax: (510) 486-7696 Email: mamarcus@lbl.gov
Beamline phone number	(510) 495-2104

Beamline 11.0.2
Molecular Environmental Science

Operational	Fall 2002
Source characteristics	5-cm-period elliptical polarization undulator (EPU5)
Energy range	See endstation tables
Monochromator	See endstation tables
Endstations	Wet Spectroscopy High-Pressure Photoemission Spectroscopy Scanning Transmission X-Ray Microscope (STXM)

Beamline 11.0.2

Molecular Environmental Science

Wet Spectroscopy

Energy range	75–2000 eV
Monochromator	Variable-included-angle PGM
Calculated flux (1.9 GeV, 400 mA)	~10^{12} photons/s
Resolving power (E/ΔE)	2500–7500
Spot size at sample (FWHM)	5 x 50 µm
Sample environment	UHV, wet environments
Scientific applications	Wet molecular environmental science
Experimental techniques	XPS, NEXAFS, fluorescence spectroscopy
Local contact/spokesperson	Name: David Shuh Affiliation: Chemical Sciences Division, Berkeley Lab Phone: (510) 486-6937 Fax: (510) 486-5596 Email: dkshuh@lbl.gov

Beamline 11.0.2

Molecular Environmental Science

High-Pressure Photoemission Spectroscopy

Energy range	75–2000 eV
Monochromator	Variable-included-angle PGM
Calculated flux (1.9 GeV, 400 mA)	~10^{12} photons/s
Resolving power (E/ΔE)	2500–7500
Spot size at sample (FWHM)	~10 x 100 µm
Sample environment	UHV, high pressure to 10 Torr
Scientific applications	Wet molecular environmental science, catalysis
Experimental techniques	XPS, NEXAFS
Local contact	Name: Frank Ogletree Phone: (510) 486-4862 Fax: (510) 486-4995 Email: dfogletree@lbl.gov
Spokesperson	Name: David Shuh Affiliation: Chemical Sciences Division, Berkeley Lab Phone: (510) 486-6937 Fax: (510) 486-5596 Email: dkshuh@lbl.gov

Beamline 11.0.2

Molecular Environmental Science

Scanning Transmission X-Ray Microscope (STXM)

Energy range	180–1000 eV
Monochromator	Variable-included-angle PGM
Calculated flux (1.9 GeV, 400 mA)	~10^9 photons/s/0.01% BW
Resolving power (E/ΔE)	3000 (typical), 5000 (optimized)
Characteristics	Used to make x-ray images and NEXAFS spectra of thin samples in transmission
Spatial resolution	Scanning microscope with focusing by means of Fresnel zone plates; resolution determined by spot size, which is 40 nm with current zone plates but will improve with new zone plates
Detectors	Photon-counting detector behind the sample records the intensity of the transmitted radiation, generating an image pixel by pixel during the rastering
Spot size at sample	40 nm with current zone plates
Samples	
Format	Thin sections or films (100 nm thick), 3 x 3 mm in area
Preparation	No preparation chamber available
Sample environment	Helium at 1 atm
Special notes	Samples may be wet or dirty; thin films may be deposited on silicon nitride windows; optical alignment is provided by looking at the back side of the sample to locate regions of interest from optical micrographs
Scientific applications	Molecular environmental science STXM
Experimental techniques	Imaging, NEXAFS in small spots
Local contact	Name: Tony Warwick Phone: (510) 486-5819 Fax: (510) 486-7696 Email: t_warwick@lbl.gov
Spokesperson	Name: David Shuh Affiliation: Chemical Sciences Division, Berkeley Lab Phone: (510) 486-6937 Fax: (510) 486-5596 Email: dkshuh@lbl.gov

Beamline 11.3.1
Small-Molecule Crystallography

Operational	2002
Source characteristics	Bend magnet
Energy range	6–17 keV
Monochromator	Channel-cut Si(111)
Calculated flux (1.9 GeV, 400 mA)	4 x 10^{12} photons/s/0.01%BW at 12 keV
Resolving power (E/ΔE)	1000
Endstations	Medium-sized hutch with optical table
Detectors	Large area x-ray scintillator/CCD detector
Spot size at sample	250 µm x 100 µm
Samples	
Format	Crystals as small as 15µm x 15µm x 15µm
Preparation	Crystals are mounted on standard goniometer head
Sample environment	Air
Special notes	Bruker SMART software is used for diffraction analysis
Experimental techniques	X-ray diffraction and small-angle scattering
Scientific applications	Crystal structure of compounds
Local contact/spokesperson	Name: Al Thompson Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-5590 Fax: (510) 486-7696 Email: acthompson@lbl.gov
Beamline phone number	(510) 495-2114

Beamline 11.3.2
Inspection of EUV Lithography Masks

Operational	Now
Source characteristics	Bend magnet
Energy range	50–1000 eV
Monochromator	VLS-PGM
Calculated flux (1.9 GeV, 400 mA)	10^{11} photons/s/0.01%BW at 100 eV
Resolving power (E/ΔE)	7000
Endstations	Scanning bright field and dark field mask inspection
Spot size at sample	2.5 x 4 µm
Local contact	Name: Moonsuk Yi Phone: (510) 486-4954 Email: msyi@lbl.gov
Spokesperson	Name: Jeffrey Bokor Affiliation: Univ. of California, Berkeley; Center for X-Ray Optics, Berkeley Lab Phone: (510) 642-4134 Fax: (510) 642-2739 Email: jbokor@eecs.berkeley.edu
Beamline phone number	(510) 495-2117

Beamline 12.0.1

EUV Optics Testing and Interferometry, Angle- and Spin-Resolved Photoemission

Operational	See endstation tables
Source characteristics	8-cm-period undulator (U8)
Energy range	See endstation tables
Monochromator	See endstation tables
Endstations	EUV Interferometer (2 available) Angle- and Spin-Resolved Photoemission (2002)
Beamline phone numbers	(510) 495-2120, (510) 495-2121

Beamline 12.0.1

EUV Optics Testing and Interferometry, Angle- and Spin-Resolved Photoemission

EUV Interferometer (2 available)

Operational	Now
Energy range	60–320 eV
Monochromator	VLS-PGM
Calculated flux (1.9 GeV, 400 mA)	~ 5 x 10^{13} photons/s/1%BW at 134 eV
Resolving power (E/ΔE)	200–10,000
Detectors	GaAsP flux monitor, silicon 1024 x 1024 CCD array
Samples	
Preparation	All-reflective, multilayer-coated EUV optics
Sample environment	10^{-7} or 10^{-4} Torr O_2
Special notes	Interferometer stations also support different modes of high-resolution EUV pattern transfer capabilities
Scientific applications	Interferometric wavefront measurement of optics designed for EUV lithography
Local contacts	Name: Kenneth Goldberg Phone: (510) 495-2261 Fax: (510) 486-4550 Email: kagoldberg@lbl.gov Name: Patrick Naulleau Phone: (510) 486-4529 Fax: (510) 486-4550 Email: pnaulleau@lbl.gov
Spokespersons	Name: Jeffrey Bokor Affiliation: Univ. of California, Berkeley; Center for X-Ray Optics, Berkeley Lab Phone: (510) 642-4134 Fax: (510) 642-2739 Email: jbokor@eecs.berkeley.edu Name: David Attwood Affiliation: EUV/LLC Phone: (510) 486-4463 Fax: (510) 486-4966 Email: attwood@eecs.berkeley.edu

Beamline 12.0.1

EUV Optics Testing and Interferometry, Angle- and Spin-Resolved Photoemission

Angle- and Spin-Resolved Photoemission

Operational	2002
Energy range	20–320 eV
Monochromator	VLS-PGM, with two gratings (200 and 1200 lines/mm)
Calculated flux (1.9 GeV, 400 mA)	~ 5 x 10^{13} photons/s/1%BW at 134 eV
Resolving power (E/ΔE)	200–10,000
Detectors	Scienta SES 100 (angle-resolved photoemission) and Scienta SES 200 (spin-resolved photoemission)
Samples	
Format	UHV-compatible solids
Preparation	Sample manipulator with five degrees of freedom; temperature control from 20 to 1500 K
Sample environment	UHV
Scientific applications	Angle- and spin-resolved photoemission
Local contact	Name: Alexei Fedorov Phone: (510) 495-7521 Fax: (510) 486-4299 Email: avfedorov@lbl.gov
Spokesperson	Name: Dan Dessau Affiliation: Univ. of Colorado at Boulder Phone: (303) 492-1607 Fax: (303) 492-2998 Email: dessau@spot.colorado.edu

Beamline 12.2.2

California High-Pressure Science Observatory (Calipso)

Operational	2002
Source characteristics	Superbend
Energy range	See endstation tables
Monochromator	See endstation tables
Scientific applications	High-pressure science
Experimental techniques	Diffraction, spectroscopy, small- and wide-angle scattering.
Endstations	Nanoscience/Materials Chemistry Solid-State Physics/Geoscience

Beamline 12.2.2

California High-Pressure Science Observatory (Calipso)

Nanoscience/Materials Chemistry

Characteristics	Small grain sizes, weak scattering, low to medium pressures (up to 600 kbar).
Energy range	6–40 keV
Monochromator #1	Double-crystal Si(111)
Calculated flux (1.9 GeV, 400 mA)	2×10^{11} ph/s through a 100-µm aperture at 20 keV
Resolving power (E/ΔE)	7000
Monochromator #2	Multilayer
Calculated flux (1.9 GeV, 400 mA)	6×10^{12} ph/s through a 100-µm aperture at 20 keV
Resolving power (E/ΔE)	100
Spatial resolution	20 µm
Detectors	Mar345 imaging plate and MarCCD
Spot size at sample	138 (h) x 71 (v) µm FWHM
Samples	
Format	Powders, liquids, and suspensions
Preparation	Loaded into diamond anvil cells
Sample environment	Diamond anvil cells
Special notes	End station will be set-up for high throughput with automated data collection, pressurization and pressure measurement.
Local contact	Name: Simon Clark Phone: (510) 495-2442 Fax: (510) 495-2067 Email: smclark@lbl.gov
Spokespersons	Name: Paul Alivisatos Affiliation: Univ. of California, Berkeley Phone: (510) 643-7371 Fax: (510) 642-6911 Email: alivis@uclink4.berkeley.edu Name: Howard Padmore Affiliation: Advanced Light Source, Berkeley Lab Phone: (510) 486-5787 Fax: (510) 486-7696 Email: hapadmore@lbl.gov

Beamline 12.2.2

California High-Pressure Science Observatory (Calipso)

Solid-State Physics/Geoscience

Characteristics	Large grain sizes, very high pressure (>1.5 Mbar)
Energy range	6–40 keV
Monochromator	Double-crystal Si(111)
Calculated flux (1.9 GeV, 400 mA)	3 x 10^9 ph/s through a 10-µm aperture at 20 keV
Resolving power (E/ΔE)	7000
Spatial resolution	20 µm
Detectors	Mar345 imaging plate and MarCCD; ion chambers and solid-state detectors will be available for XAS measurements
Spot size at sample	18 x 78 µm FWHM (adjustable)
Samples	
Format	Powders and liquids
Preparation	Loaded into diamond anvil cells with inert gases or other pressure-transmitting fluids
Sample environment	Diamond anvil cells
Special notes	Samples will be laser heated; online pressure measurement and standard spectroscopies will be available
Local contact	Name: Simon Clark Phone: (510) 495 2442 Fax: (510) 495 2067 Email: smclark@lbl.gov
Spokespersons	Name: Raymond Jeanloz Affiliation: Univ. of California, Berkeley Phone: (510) 642-2639 Fax: (510) 643-9980 Email: jeanloz@uclink.berkeley.edu Name: Howard Padmore Affiliation: Advanced Light Source Phone: (510) 486-5787 Fax: (510) 486-7696 Email: hapadmore@lbl.gov

Beamline 12.3.1

Multiple-Wavelength Anomalous Diffraction (MAD) Protein Crystallography and Small-Angle X-Ray Scattering (SAXS)

Operational	2002
Source characteristics	Superbend
Energy range	6–18 keV
Monochromator #1	Double crystal
Calculated flux (1.9 GeV, 400 mA)	5 x 10^{11} photons/s (100 µm collimator)
Resolving power (E/ΔE)	7000
Monochromator #2	Double multilayer
Calculated flux (1.9 GeV, 400 mA)	4 x 10^{13} photons/s
Resolving power (E/ΔE)	100
Endstations	Hutch
Detectors	Monochromator #1: 2 x 2 array CCD
	Monochromator #2: Fast wire chamber
Calculated spot size at sample (FWHM)	Monochromator #1: 65 x 150 µm
	Monochromator #2: 6 x 1 mm
Samples	
Format	Monochromator #1: Single-crystal biomolecules
	Monochromator #2: Solutions
Preparation	Support labs available
Sample environment	Monochromator #1: Cryofrozen crystals
	Monochromator #2: Liquid cell
Special notes	Computers for data processing and analysis are available
Scientific applications	Biological crystallography; multiple-wavelength anomalous diffraction (MAD), small-angle x-ray scattering (SAXS)
Local contact	Name: Howard Padmore Phone: (510) 486-5787 Fax: (510) 486-7696 Email: hapadmore@lbl.gov
Spokesperson	Name: John Tainer Affiliation: The Scripps Research Institute Phone: (858) 784-8119 Fax: (858) 784-2277 Email: jat@scripps.edu

Beam Test Facility

Operational	Now
Electron beam energy	50 MeV
Charge/bunch	1–1.5 nC
Bunch length	25–35 ps
Emittance	0.2–0.5 mm-mrad
Number of bunches/macropulse	1–8
Repetition rate	1, 2 Hz
Minimum spot size	35 µm
Lasers	Nd:YAG λ = 1.064 µm, 0.532 µm, 0.266 µm ε = 1 J, 0.5 J, 0.1 J τ = 9 ns, 7 ns, 4–5 ns Rep. rate: 10 Hz
Local contact/spokesperson	Name: Wim Leemans Affiliation: Center for Beam Physics, Berkeley Lab Phone: (510) 486-7788 Fax: (510) 486-7981 Email: wpleemans@lbl.gov
Beamline phone number	(510) 495-7788